

DATABASES

DATABASES AND SPREADSHEETS

Knowledge of technology

In order to study and evaluate the social and ethical issues involved in the use of databases, the student must have an understanding of related technological concepts. These may include the following.

Design and creation concepts

Key terms

- Field, key field, record,
- Search, query, sort,
- Database management system,
- Mail merge
- Flat-file database versus relational database
- Paper files versus electronic files
- Data redundancy and data integrity
- Updating data

Storage and access concepts

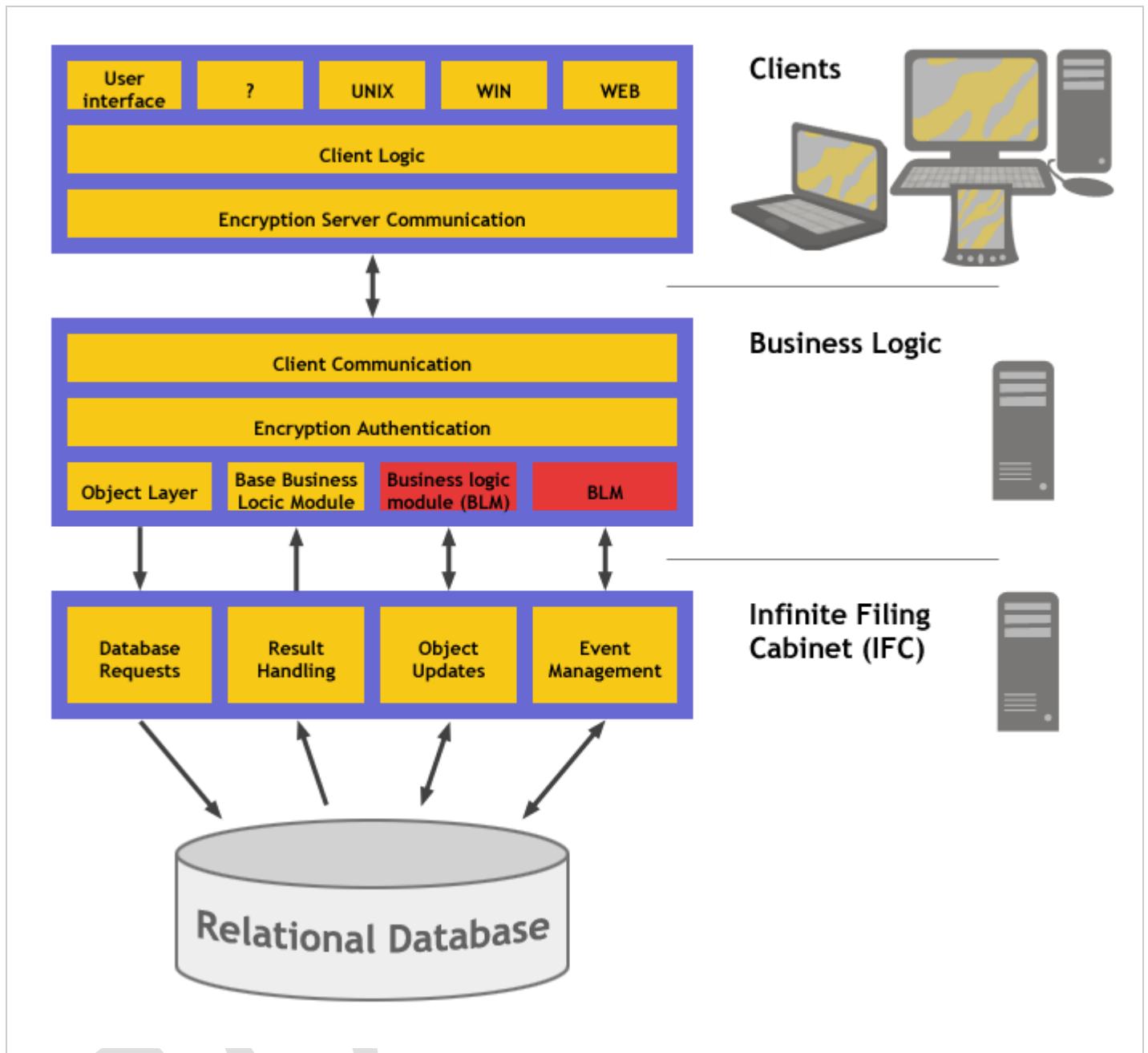
- Data transfer between a database and a spreadsheet
- Search and the use of the Boolean operators (AND, OR and NOT)
- Boolean machine
- Data mining/data matching

Presentation concepts

- Report generation
- Special-purpose databases, for example, personal information managers, encyclopaedias, library systems

In order to study and evaluate the social and ethical issues involved in the use of spreadsheets, the student must have an understanding of related technological concepts. These may include the following. Design and creation concepts





Key terms

- cell, cell format (number, text, value, function, calculation, date, currency),
- row, column, label,
- macro,
- replicate,
- template, worksheet,
- "what if" questions,
- range, absolute and relative reference
- Paper files versus electronic files
- Reliability and integrity of data

Storage and access concepts

- Data transfer between a database and a spreadsheet

Presentation concepts

- Select, print and display area of a worksheet
- Use of the appropriate graph or chart for the meaningful representation of information
- Special-purpose spreadsheets, for example, inventory, budget

Social and ethical issues

Students must study and evaluate the social and ethical issues involved in the use of databases and spreadsheets. These may include:

- Privacy of information in different cultures
- Rights of individuals with respect to the storage of personal data
- Social consequences of outdated or incorrect data stored in databases social consequences of the release of sensitive data stored in databases
- Legislation on access and use of database information in different countries
- Responsibility for the security of data stored in databases from different perspectives, for example, the developer, the user and the management of an organization
- Accountability for the negative social effects caused by insecure databases
- Ethical issues related to the collection and use of personal data
- Ethical issues related to the selling of data stored in databases.

REFERENCES

Excerpted from Information technology in a global society: guide. Cardiff Wales, UK: International Baccalaureate Organization, 2006.

A Database Management System (DBMS) is a set of computer programs that controls the creation, maintenance, and the use of a database. It allows organizations to place control of database development in the hands of database administrators (DBAs) and other specialists. A DBMS is a system software package that helps the use of integrated collection of data records and files known as databases. It allows different user application programs to easily access the same database. DBMSs may use any of a variety of database models, such as the network model or relational model. In large systems, a DBMS allows users and other software to store and retrieve data in a structured way. Instead of having to write computer programs to extract information, user can ask simple questions in a query language. Thus, many DBMS packages provide Fourth-generation programming language (4GLs) and other application development features. It helps to specify the logical organization for a database and access and use the information within a database. It provides facilities for controlling data access, enforcing data integrity, managing concurrency, and restoring the database from backups. A DBMS also provides the ability to logically present database information to users.

Mail merge is a software function describing the production of multiple (and potentially large numbers of) documents from a single template form and a structured data source

Flat File Database

A flat file database is a database designed around a single table. The flat file design puts all database information in one table, or list, with fields to represent all parameters. A flat file may contain many fields, often, with duplicate data that are prone to data corruption. If you decide to merge data between two flat files, you need to copy and paste relevant information from one file to the other. There is no automation between flat files. If you have two or more flat files that contain client addresses, for example, and a client moved, you would have to manually modify the address parameters in each file that contains that client's information. Changing information in one file has no bearing on other files. Flat files offer the functionality to store information, manipulate fields, print or display formatted information and exchange information with others, through email and over the Internet. Some flat files may be attached to external files, such as text editors, to extend functionality and manage related information.

Relational Database

A relational database, on the other hand, incorporates multiple tables with methods for the tables to work together. The relationships between table data can be collated, merged and displayed in database forms. Most relational databases offer functionality to share data:

- Across networks
- Over the Internet
- With laptops and other electronic devices, such as palm pilots
- With other software systems

Designing flat file databases is simple and requires little design knowledge. Flat files can be developed using just about any database engine. Flat files can be created in relational database engines by not taking advantage of relational design concepts. Designing a relational database takes more planning than flat file databases. With flat files, you may add information, as you deem necessary. With relational databases, you must be careful to store data in tables such that the relationships make sense. Building a relational database is dependant upon your ability to establish a relational model. The model must fully describe how the data is organized, in terms of data structure, integrity, querying, manipulation and storage.

Relational databases allow you to define certain record fields, as keys or indexes, to perform search queries, join table records and establish integrity constraints. Search queries are faster and more accurate when based on indexed values. Table records can be easily joined by the indexed values. Integrity constraints can be established to ensure that table relationships are valid. If you are able to establish a one-to-many relationship in your data tables, you should be using a relational database because a flat file is not sufficient to handle your data processing needs.

Relational databases offer more robust reporting with report generators that filter and display selected fields. Relational databases offer the capability to build your own reporting modules. Most relational databases also offer the capability to import and export data from other software.

There are three primary relational database systems, proprietary, open source and embedded. Proprietary relational databases require the use of proprietary development languages, often times, to complement SQL. Microsoft Access, for example, combines Visual Basic with SQL. Open source databases, such as MySQL, are distributed freely to encourage user development. Embedded, relational databases are packaged as part of other software packages, such as with tax-preparation software packages. The vendor supplies the database, and all manipulation tools, to control the database structure. These databases are, often times, accompanied with tools to provide audit trails of transactions

Resource: <http://www.databasedev.co.uk/>

Data Redundancy Defined

Data redundancy is a data organization issue that allows the unnecessary duplication of data within your Microsoft Access database. A change or modification, to redundant data, requires that you make changes to multiple fields of a database. While this is the expected behaviour for flat file database designs and spreadsheets, it defeats the purpose of relational database designs. The data relationships, inherent in a relational database, should allow you to maintain a single data field, at one location, and make the database's relational model responsible to port any changes, to that data field, across the database. Redundant data wastes valuable space and creates troubling database maintenance problems.

To eliminate redundant data from your Microsoft Access database, you must take special care to organize the data in your data tables. Normalization is a method of organizing your data to prevent redundancy. Normalization involves establishing and maintaining the integrity of your data tables as well as eliminating inconsistent data dependencies.

Establishing and maintaining integrity requires that you follow the Access prescribed rules to maintain parent-child, table relationships. Eliminating inconsistent, data dependencies involves ensuring that data is housed in the appropriate Access database table. An appropriate table is a table in which the data has some relation to or dependence on the table.

Normalization requires that you adhere to rules, established by the database community, to ensure that data is organized efficiently. These rules are called normal form rules. Normalization may require that you include additional data tables in your Access database. Normal form rules number from one to three, for most applications. The rules are cumulative such that the rules of the 2nd normal form are inclusive of the rules in the 1st normal form. The rules of the 3rd normal form are inclusive of the rules in the 1st and 2nd normal forms, etc.

Resource: <http://www.databasedev.co.uk/>

INTEGRITY

Integrity refers to correspondence of data with itself, at its creation. Data lacks integrity when it has been changed accidentally or tampered with. For example, a hacker might change driver licence data resulting in arrests of innocent people.

responsibility for the security of data stored in databases from different perspectives, for example, the developer, the user and the management of an organization

Poor data reliability and integrity can have enormous social, political and economic impacts.

<http://www.smh.com.au/news/world/image-digitally-manipulated/2007/10/18/1192300893284.html>

Data Mining: What is Data Mining?

Overview

Generally, data mining (sometimes called data or knowledge discovery) is the process of analyzing data from different perspectives and summarizing it into useful information - information that can be used to increase revenue, cuts costs, or both. Data mining software is one of a number of analytical tools for analyzing data. It allows users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships identified. Technically, data mining is the process of finding correlations or patterns among dozens of fields in large relational databases.

Continuous Innovation

Although data mining is a relatively new term, the technology is not. Companies have used powerful computers to sift through volumes of supermarket scanner data and analyze market research reports for years. However, continuous innovations in computer processing power, disk storage, and statistical software are dramatically increasing the accuracy of analysis while driving down the cost.

Example

For example, one Midwest grocery chain used the data mining capacity of [Oracle](#) software to analyze local buying patterns. They discovered that when men bought diapers on Thursdays and Saturdays, they also tended to buy beer. Further analysis showed that these shoppers typically did their weekly grocery shopping on Saturdays. On Thursdays, however, they only bought a few items. The retailer concluded that they purchased the beer to have it available for the upcoming weekend. The grocery chain could use this newly discovered information in various ways to increase revenue. For example, they could move the beer display closer to the diaper display. And, they could make sure beer and diapers were sold at full price on Thursdays.

Data, Information, and Knowledge

Data

Data are any facts, numbers, or text that can be processed by a computer. Today, organizations are accumulating vast and growing amounts of data in different formats and different databases. This includes:

- operational or transactional data such as, sales, cost, inventory, payroll, and accounting

- nonoperational data, such as industry sales, forecast data, and macro economic data
- meta data - data about the data itself, such as logical database design or data dictionary definitions

Information

The patterns, associations, or relationships among all this *data* can provide *information*. For example, analysis of retail point of sale transaction data can yield information on which products are selling and when.

Knowledge

Information can be converted into *knowledge* about historical patterns and future trends. For example, summary information on retail supermarket sales can be analyzed in light of promotional efforts to provide knowledge of consumer buying behavior. Thus, a manufacturer or retailer could determine which items are most susceptible to promotional efforts.

Data Warehouses

Dramatic advances in data capture, processing power, data transmission, and storage capabilities are enabling organizations to integrate their various databases into *data warehouses*. Data warehousing is defined as a process of centralized data management and retrieval. Data warehousing, like data mining, is a relatively new term although the concept itself has been around for years. Data warehousing represents an ideal vision of maintaining a central repository of all organizational data. Centralization of data is needed to maximize user access and analysis. Dramatic technological advances are making this vision a reality for many companies. And, equally dramatic advances in data analysis software are allowing users to access this data freely. The data analysis software is what supports data mining.

What can data mining do?

Data mining is primarily used today by companies with a strong consumer focus - retail, financial, communication, and marketing organizations. It enables these companies to determine relationships among "internal" factors such as price, product positioning, or staff skills, and "external" factors such as economic indicators, competition, and customer demographics. And, it enables them to determine the impact on sales, customer satisfaction, and corporate profits. Finally, it enables them to "drill down" into summary information to view detail transactional data.

With data mining, a retailer could use point-of-sale records of customer purchases to send targeted promotions based on an individual's purchase history. By mining

demographic data from comment or warranty cards, the retailer could develop products and promotions to appeal to specific customer segments.

For example, Blockbuster Entertainment mines its video rental history database to recommend rentals to individual customers. American Express can suggest products to its cardholders based on analysis of their monthly expenditures.

WalMart is pioneering massive data mining to transform its supplier relationships. WalMart captures point-of-sale transactions from over 2,900 stores in 6 countries and continuously transmits this data to its massive 7.5 terabyte Teradata data warehouse. WalMart allows more than 3,500 suppliers, to access data on their products and perform data analyses. These suppliers use this data to identify customer buying patterns at the store display level. They use this information to manage local store inventory and identify new merchandising opportunities. In 1995, WalMart computers processed over 1 million complex data queries.

The National Basketball Association (NBA) is exploring a data mining application that can be used in conjunction with image recordings of basketball games. The Advanced Scout software analyzes the movements of players to help coaches orchestrate plays and strategies. For example, an analysis of the play-by-play sheet of the game played between the New York Knicks and the Cleveland Cavaliers on January 6, 1995 reveals that when Mark Price played the Guard position, John Williams attempted four jump shots and made each one! Advanced Scout not only finds this pattern, but explains that it is interesting because it differs considerably from the average shooting percentage of 49.30% for the Cavaliers during that game.

By using the NBA universal clock, a coach can automatically bring up the video clips showing each of the jump shots attempted by Williams with Price on the floor, without needing to comb through hours of video footage. Those clips show a very successful pick-and-roll play in which Price draws the Knick's defense and then finds Williams for an open jump shot.

How does data mining work?

While large-scale information technology has been evolving separate transaction and analytical systems, data mining provides the link between the two. Data mining software analyzes relationships and patterns in stored transaction data based on open-ended user queries. Several types of analytical software are available: statistical, machine learning, and neural networks. Generally, any of four types of relationships are sought:

- **Classes:** Stored data is used to locate data in predetermined groups. For example, a restaurant chain could mine customer purchase data to determine when customers visit and what they typically order. This information could be used to increase traffic by having daily specials.

- **Clusters:** Data items are grouped according to logical relationships or consumer preferences. For example, data can be mined to identify market segments or consumer affinities.
- **Associations:** Data can be mined to identify associations. The beer-diaper example is an example of associative mining.
- **Sequential patterns:** Data is mined to anticipate behavior patterns and trends. For example, an outdoor equipment retailer could predict the likelihood of a backpack being purchased based on a consumer's purchase of sleeping bags and hiking shoes.

Data mining consists of five major elements:

- Extract, transform, and load transaction data onto the data warehouse system.
- Store and manage the data in a multidimensional database system.
- Provide data access to business analysts and information technology professionals.
- Analyze the data by application software.
- Present the data in a useful format, such as a graph or table.

Different levels of analysis are available:

- **Artificial neural networks:** Non-linear predictive models that learn through training and resemble biological neural networks in structure.
- **Genetic algorithms:** Optimization techniques that use processes such as genetic combination, mutation, and natural selection in a design based on the concepts of natural evolution.
- **Decision trees:** Tree-shaped structures that represent sets of decisions. These decisions generate rules for the classification of a dataset. Specific decision tree methods include Classification and Regression Trees (CART) and Chi Square Automatic Interaction Detection (CHAID). CART and CHAID are decision tree techniques used for classification of a dataset. They provide a set of rules that you can apply to a new (unclassified) dataset to predict which records will have a given outcome. CART segments a dataset by creating 2-way splits while CHAID segments using chi square tests to create multi-way splits. CART typically requires less data preparation than CHAID.
- **Nearest neighbor method:** A technique that classifies each record in a dataset based on a combination of the classes of the k record(s) most similar to it in a historical dataset (where $k \geq 1$). Sometimes called the k -nearest neighbor technique.

- **Rule induction:** The extraction of useful if-then rules from data based on statistical significance.
- **Data visualization:** The visual interpretation of complex relationships in multidimensional data. Graphics tools are used to illustrate data relationships.

What technological infrastructure is required?

Today, data mining applications are available on all size systems for mainframe, client/server, and PC platforms. System prices range from several thousand dollars for the smallest applications up to \$1 million a terabyte for the largest. Enterprise-wide applications generally range in size from 10 gigabytes to over 11 terabytes. [NCR](#) has the capacity to deliver applications exceeding 100 terabytes. There are two critical technological drivers:

- **Size of the database:** the more data being processed and maintained, the more powerful the system required.
- **Query complexity:** the more complex the queries and the greater the number of queries being processed, the more powerful the system required.

Relational database storage and management technology is adequate for many data mining applications less than 50 gigabytes. However, this infrastructure needs to be significantly enhanced to support larger applications. Some vendors have added extensive indexing capabilities to improve query performance. Others use new hardware architectures such as Massively Parallel Processors (MPP) to achieve order-of-magnitude improvements in query time. For example, MPP systems from NCR link hundreds of high-speed Pentium processors to achieve performance levels exceeding those of the largest supercomputers.

Resource: <http://www.anderson.ucla.edu/faculty/jason.frand/teacher/technologies/palace/datamining.htm>

WORD PROCESSING

WORD PROCESSING AND DESKTOP PUBLISHING

KNOWLEDGE OF TECHNOLOGY



In order to study and evaluate the social and ethical issues involved in the use of word processing and desktop publishing, the student must have an understanding of related technological concepts. These may include:

Key terms

- formatting,
 - template,
 - spell check, grammar check,
 - ASCII/unicode,
 - PDF,
- RTF, text
 - word processing versus page layout
 - appropriate use of templates
 - effective use of word processing functions to streamline production of documents
 - use of appropriate fonts, white space and line spacing to create output that communicates effectively.

SOCIAL AND ETHICAL ISSUES

Students must study and evaluate the social and ethical issues involved in the use of word processing and desktop publishing (DTP). These may include:

- Effects of DTP on the right to publish, for example, freedom of the press, free exchange of ideas
- Economic effects of DTP on business
- Intellectual property issues associated with reproduction and/or transformation of digitized text
- Effects of word processing and DTP on the workplace, for example, job loss, deskilling, surveillance
- Ergonomics/health impacts of word processing and DTP in the workplace
- Social impact of speech-enabled input/output.

Wizards

- "An interactive help utility that guides the user through a potentially complex task, such as configuring a PPP driver to work with a new modem. Wizards are often implemented as a sequence of dialog boxes which the user can move forward and backward through, filling in the details required. The implication is that the expertise of a human wizard in one of the above senses is encapsulated in the software wizard, allowing the average user to perform expertly." (Dictionary.com 2006)

The use of "wizards, assistants and online assistants in the design and creation of a product, for example, desktop-published documents, slideshows, web sites." (IBO 2006)

Try This ...

Open the Microsoft Office 2000 Word Processor

Click File --> Project Gallery --> Menus & Catalogues --> Menus

Make a Menu for favourite local restaurant

Save and Print

Generally, training is an organised special session where attendance is required, tutorials are designed for self-paced learning and wizards are little 'tips' or 'how tos' for small tasks.

Templates

A template in the IT sense is a pre-made outline or format for a file to be made in. This can be for word processing documents, style sheets, web sheets, or a software template. A software template is "generally identified as any processing element that can be combined with a data model and processed by a template engine to produce a result document." (*Wikipedia, accessed February 24, 2007*)

The most commonly known type of templates are the ones used in word processing. These types of templates include types of letters (formal and informal), reports, etc. These templates can be browsed for online by going to Microsoft Word > File > New... > then in the window on the right of the screen click the "Templates on Office Online" link.

Check out [Templates](#) for more information on all kinds of templates.

Ethical and Social Issues

- Reliability
 - The step by step tutorial, training and wizards content is correct.
 - Will work every time and be useful
 - Can be confusing or hard to follow the steps
- Globalization and Cultural Diversity

- The need for IT companies to consider global and cultural diversity preparing training and tutorial software (IBO 2006, ie language, level of language, content (images, text, etc), suit learning styles
- People and Machines
 - the requirement of organizations to provide training when implementing change. (IBO 2006)
 - the balance in responsibility between an individual and an organization for training. (IBO 2006)
 - speed and accuracy of tasks are improved
 - work is made easier and more pleasant

References

"training." Dictionary.com Unabridged (v 1.0.1). Based on the Random House Unabridged Dictionary, © Random House, Inc. 2006. 26 Oct. 2006.

<Dictionary.com<http://dictionary.reference.com/browse/training>>

"tutorial." Dictionary.com Unabridged (v 1.0.1). Based on the Random House Unabridged Dictionary, © Random House, Inc. 2006. 26 Oct. 2006.

<Dictionary.com<http://dictionary.reference.com/search?r=2&q=tutorial>>

"wizard." The Free On-line Dictionary of Computing. Denis Howe. 12 Nov. 2006.

<Dictionary.com <http://dictionary.reference.com/browse/wizard>>

Wizard image. 12 Nov. 2006. <<http://www.feebleminds-gifs.com/fantasy-pictures-5.html>>

Portable Document Format

Portable Document Format (PDF) is an open standard for document exchange.

The file format created by Adobe Systems in 1993 is used for representing documents in a manner independent of the application software, hardware, and operating system.^[2] Each PDF file encapsulates a complete description of a fixed-layout 2D document that includes the text, fonts, images, and 2D [vector graphics](#) which compose the documents. Today, 3D drawings can be embedded in PDF documents with Acrobat 3D using [U3D](#) or [PRC](#) and various other data formats.^{[3][4]}

In 1991 [Adobe Systems](#) co-founder [John Warnock](#) outlined a system called "Camelot"^[5] that evolved into the Portable Document Format (PDF).

IMAGES SOUNDS AND PRESENTATIONS

Knowledge of technology

In order to study and evaluate the social and ethical issues involved in the use of images, sound and presentations, the student must have an understanding of related technological concepts. These may include the following...

Design and creation concepts

Key terms

- animation,
- bit-map versus vector graphics,
- object-oriented,
- clip art,
- CAD,
- hypermedia, hypertext,
- pixel, resolution,
- MP3, MIDI,
- morph
- data integrity
- consistency in design elements
- use of appropriate fonts, sound, images, video to convey a specific message

Storage, processing and access concepts

- file formats, for example, storage requirements, loading time, portability
- sound, image and video capture and editing
- updating and combining sounds or images at a later point in time to create a new work of art

Social and ethical issues

Students must study and evaluate the social and ethical issues involved in the use of images, sound and presentations, for example, multimedia, slideshows, virtual reality, games. These may include:

- intellectual property relating to the copying and modifying of text, images, sound and video (fair use policies)
- copyright issues
- printed versus electronically published information
- health issues related to virtual reality
- multimedia solutions for disabled persons
- multilingual selection possibilities of CD-ROMs and DVD
- surveillance and privacy

- global access to information available on CD-ROMs versus Internet
- use of virtual actors in films
- biased information
- reliability of data
- social and ethical issues related to games.

References

Bulleted headings excerpted from Information technology in a global society: guide. Cardiff Wales, UK: International Baccalaureate Organization, 2006.

ANIMATION

What is Animation?

"Animation is a type of optical illusion. It involves the appearance of motion caused by displaying still images one after another. Often, animation is used for entertainment purposes." www.wisegeek.com

Animation can be considered a form of art. Animation is time consuming and is very costly as well. The animated frames can be either drawn, computer generated or photographed.

Animation is an Illusion

The animation is an optical illusion, because the eye is fooled by seeing a full motion from a set of still images. Of course, the continuous movement an eye sees isn't really happening. Some scientists call the theory of animation a complete **myth**.

BIT-MAP VERSUS VECTOR GRAPHICS

What is the difference between Bit-map and Vector graphs:

Bitmap images have discrete pixels that represent colour whereas **Vector** graphics are composed of lines and shapes.

Bitmap images are exactly what their name says. They are a collection of bits that form an image. The image consists of a matrix of individual dots (pixels) which all have their own color.

Vector graphics are images that are completely described using a mathematical definition. Each line is made up of either a vast collection of points with lines interconnecting all of them or just a few control points which are connected.

OBJECT-ORIENTED

The term object oriented can refer to two different things, object-oriented programming which is the more common use of the term, and object-oriented graphics, a less common use of the term.

Object-oriented programming is a method of programming in which objects in the program carry out their own assigned functions. Rather than the program giving lines of instructions to the computer in order to carry out tasks, a group of objects work together to carry out tasks. It incorporates many aspects of previous methods of programming such as inheritance, modularity, polymorphism, and encapsulation. The benefits of object-oriented programming are that the program will be more flexible and maintainable. Due to its focus on modularity, it is easier to analyze, write, and understand. It is very common in large-scale software engineering.%

"The representation of graphical objects, such as lines, arcs, circles, and rectangles, with mathematical formulas. This method of describing objects enables the system to manipulate the objects more freely. In an object-oriented system, for example, you can overlap objects but still access them individually, which is difficult in a bit-mapped system. Also, object-oriented images profit from high-quality output devices. The higher the resolution of a monitor or printer, the sharper an object-oriented image will look. In contrast, bit-mapped images always appear the same regardless of a device's resolution."-[Webopedia](#) Accessed March 26, 2007

CLIP ART

Definition

Clip art refers to pre-made electronic graphic images, designs, and artwork that can be used to illustrate almost any digital medium. The images can either be black and white or made up of multiple colors. Clip art can be obtained from a CD or can be downloaded from the Internet freely or for a small fee. It is mainly used for both commercial and personal use.

A Brief History

'The term "clip art" actually originated through the practice of physically cutting images from pre-existing printed works for use in other publishing projects'*. But back then, it was known as 'paste up.' Although in the 1990s many publishers and designers replaced 'paste up' with desktop publishing.

The first actual library of clip art was created by VCN Execuvision for the IBM PC in 1983. This clip art was mainly used to illustrate business presentations. Then in 1985, software maker Aldus introduced PageMaker which offered professional quality desktop publishing

to the public. The personal use of desktop publishing for homemade newsletters and brochures had people asking for pre-made images. But the clip art that was first introduced was made up of simple line art due to the lack the needed tools. That's when T/Maker Company, a Mountain View, California company stepped in.

T/Maker took the Mac's ability to provide bitmapped images in black and white. The images they created were manly for personal use and were copyrighted under the name of 'ClickArt'. Then in 1986, Adobe Systems introduced Adobe Illustrator for the Mac which made it possible for people to manipulate GUI images and the images T/Maker had created.

In the 1990s, several clip art companies saw the advantages of offering CD-ROMs with electronic clip art. During this time, word processing companies such as Microsoft began incorporating clip art in their products. Today, Microsoft offers more than 140,000 clip art images in their Microsoft Office.

After the success of clip art CD-ROMs, companies began to distribute their clip art online. Some of the popular clip art sites include Clipart.com , WeddingClipart.com and GraphicsFactory.com .

- References:

Wikipaida, Clip art. Multiple editors. 2007. 20 March 2007. <http://en.wikipedia.org/wiki/Clip_art>

CAD (COMPUTER AIDED DESIGN)

What is CAD?

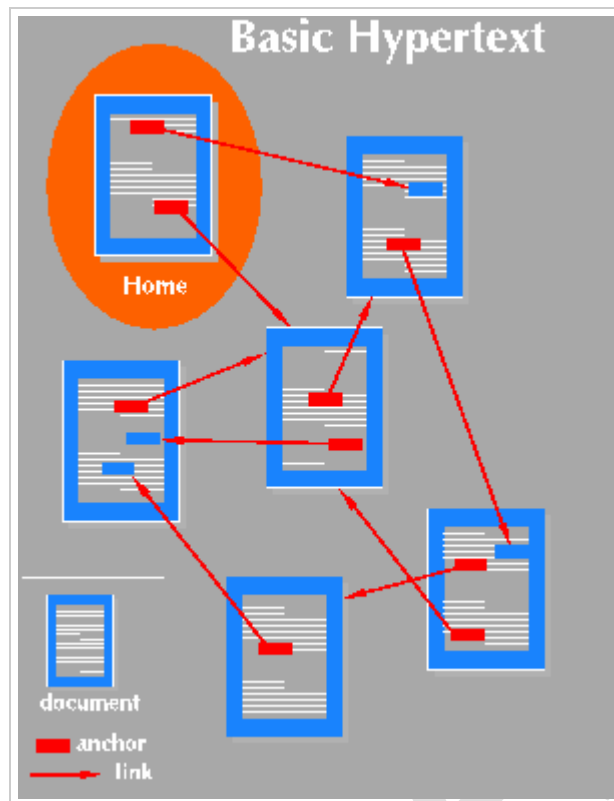
CAD stands for computer aided design. It is a combination of hardware and software which enables engineers and architects to design anything they need and view it from any angle. Only a couple years ago you would have to buy a special computer for **CAD**, but nowadays you only need the software and a general purpose computer.

The **CAD** software can only give a 2D picture, but the computer can be connected to a machine, which can make the exact model as the architect or engineer sees on the screen in 3D through the **binary** data transformation which give the **machine** orders how to cut and drill.



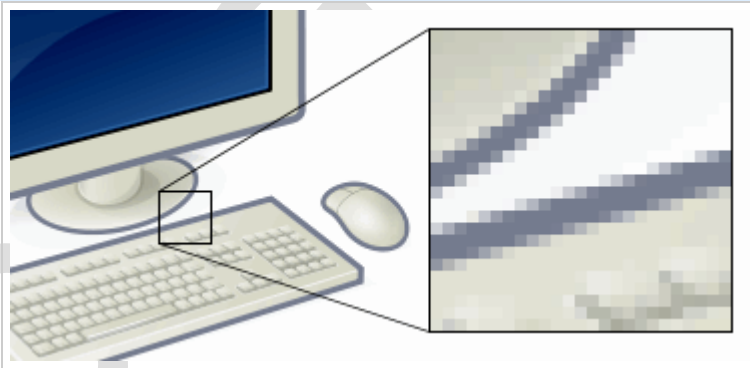
HYPERMEDIA HYPERTEXT

What is hypertext and hypermedia? They are: "Links that display as words are generally underlined to denote them as clickable and are true "hypertext" links. Icons and graphic elements of all sizes and shapes can also serve as clickable links, but are more accurately called "[hypermedia]." Thus, hyperlinks are technically either hypertext or [hypermedia]. In practice, the terms "hypertext" and "hyperlink" are used the mostly frequently, and often synonymously." Answers.com, Accessed April 2007



PIXEL

Information



An enlarged part of the image shows the individual pixels which are represented as little squares.

Pixel stands for 'Picture Element'. A pixel is basically a single point in an electronic image. It has a given color and brightness. A pixel is usually made up of variations of the colors red, green and blue, or cyan, magenta, yellow, and black.

The number of pixels used also determines the resolution of the image. The more pixels, the higher the resolution and less pixels results in a lower resolution.

Pixels can be expressed in a single number. For example, a four-megapixel digital camera has four million pixels per image. It can also be expressed as a pair of numbers

as in a 640 by 480 display. This means that there are 640 pixels horizontally and 480 pixels vertically. The total number of pixels in this type of image is $640 \times 480 = 307,200$ pixels.

- References:

Wikipedia, Pixel. Multiple editors. 2007. 20 March 2007. <<http://en.wikipedia.org/wiki/Pixel>>

RESOLUTION

Resolution

Resolution refers to the clarity and detail of an image. It is used to describe the detail of monitors, printers, or graphic images. Each graphic device can be classified under the three resolution classes, high resolution, medium resolution, and low resolution.

For graphic monitors, the screen resolution depends on the number of total pixels on the screen. For example, a 640 by 480 pixel screen is capable of displaying 640 unique dots on each of 480 lines which is about 300,000 pixels

In any graphic device, the higher number of pixels results in a higher resolution. The higher the resolution, the higher the picture quality and detail.

MP 3

What is it?

From the technical point of view the MP3 stands for **MPEG1 Audio Layer 3**. But what does that mean? We are all familiar with that phrase as our extension files are usually ending with .mp3 (like most of our songs are). An MP3 is a digital audio encoding method, being able to reduce the amount of data required to represent the digital sound. But why do we need this Audio Layer 3? Simply because it shrinks the data without sacrificing the audio quality. Let's take an example of a compact disc (CD) which has about 1411 kilobits. What the Layer will do is that it will compress the data as almost as 12 times (down to 128 kbs) so it could be easily transferred across the computer platform and the internet.

ID3 and tags?

Well, so have you ever wondered how your iTunes is able to recognize the songs that you put in? Ok, so a "tag" is compressed information stored in the metadata section of

the file. It can store the information about the artist , genre, title of the song, album information and even the digital covers (art , usually displayed as JPEG pictures).

So how have this all started?

Basically, in the early 1990's and the beginning of 1995 , the MP3's began to spread around the Internet. The popularity rose as the Nullsoft released its audio player, Winamp , the peer-to-peer sharing was at first introduced by Napster and when some of the websites started uploading MP3's and converting the CD's into this format. There is also an another issue , as theMP3's popularity rose, some of the companies started to use special proprietary formats in which the MP3's are encrypted (known as Digital Rights Management) to prevent users from using purchased music. But this has many side effects such as when the users purchase their music on one device , they will not be able to play it back on different volumes.

When creating an MP3 the user chooses to actually pick a specific bit rate of data encoding. But there is s trade-off between the space used for the MP3 and the quality of sound. The lower you pick the size , the less reliable the MP3 will be. There are some limitations when it comes to creating or managing the MP3 songs and dealing with the format itself. The bit quality is limited to 320Kbs.

MIDI

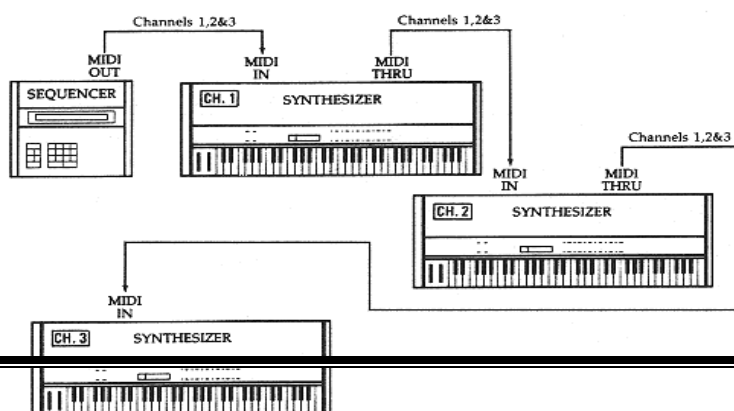


MIDI is an acronym and stands for musical instrument digital interface. But what precisely is it? It is used to control

sound devices in many music industries and computers. It is a standard , and every device that uses it in order to control music , (like a synthesizer or a sound card) must follow it. At minimum, a MIDI representation of a sound includes values for the note's pitch, length, and volume. It can also include additional characteristics, such as attack and delay time. Some other way to explain this is

maybe that MIDI is a system very much like a **player piano roll** in that it is used to specify the actions of a synthesizer or other electronic devices, while the tone or effect is generated by the instrument itself.

Many computers that have a MIDI interface can **record sounds created by a synthesizer and then change the data to produce new sounds.** For example, you can change the key of a composition with a single keystroke on your keyboard.



An example of how MIDI is used in music industry.

There are tons of software programs that are available for composing and editing music that includes the MIDI

standard. They offer a variety of functions: for instance, when you play a tune on a keyboard connected to a computer, a music program can translate what you play into a written score. Isn't that cool? :)

MORPH

Morph refers to the imaging or motion picture technique in which one image is changed into another. In the case of it being done with still images, it consists of several images, one end having the starting image, and the other end having the final image. The goal is to make the first image appear to smoothly blend and transform into the final image. In motion pictures and animations, there are no still pictures. So for a movie, as the frames go along, an object or character is changed subtly in each frame, so that after a certain amount of time and frames, the end result will be a different object or character that resulted from the original. This is done so that it is one smooth transformation, and the steps cannot be detected by the human eye. This is a common special effect for fantasy movies, and any scene in a film where something magical or sci-fi related is happening, such as a person transforming into an animal, or a boat transforming into a car.

Before the widespread use of computers, this technique would have to be done on the film itself. However, since the 1990's, computers and IT systems have since taken over this task and improved it. As the technology progressed from Analog to Digital, the technique became more realistic and convincing. Rather than cross-fading film, and being forced to use stationary scenes while doing it, the use of computers has enabled detailed morphing. Through techniques such as grid morphing and vector morphing, certain parts can be morphed specifically. Even focal points can be mapped out to make a more highly accurate morph, for example from a face to another face.

DATA INTEGRITY

What is it exactly?

Data integrity simply refers to the **validity of data**. The stuff "integrates" when it becomes valid, in case of data, the integrity will determine if the data is correct or not. Data integrity should ensure that the **same data is accessed only by those who are authorized and have the rights to alter it**. The integrity should also assure that the data is **identically maintained** during any operations (such as data transfer or retrieval). The data **must be complete or "whole"** as some people say. But what is it? It is like having an ID number 1523 assigned to a certain person. Without referring to the certain person with the same ID match, the data would be incomplete or not "whole".

How could data become invalid therefore not integrate ?

As we play with data and we alter it in some ways, there are always some specific circumstances under which, the data might become incorrect. Here are some examples of how it happens:

- When entering data humans could make mistakes
- Software bugs? or viruses
- Problems while transferring data from one PC to another
- Hardware malfunctioning, such as a disk crash or format.
- Natural disasters (not in many cases though, like fire or flood may be a reason)

Well, if the data gets invalid, how can we prevent it?

- Always back up? your data regularly (a month or so)
- Use software that may prevent the data violation (such as anti virus and firewall?)
- Use error detection software to prevent such mistakes from happening

FILE FORMATS

Here are some common file types along with their details:

Extension	Type	Features	Storage Requirements	Loading Time	Portability
.avi	video clip	Audio/Video movie clip. Can be opened with - media-player, Internet Explorer, or Navigator with plugin	Depends on the resolution of the video and its length. Can be anywhere from 2MB to 700MB	Depends on size	Intermediate - depending on size
.bmp	Graphic file	Opens images in Microsoft Paint or in other graphics programs	Depends on the size and resolution of the graphic	Usually quick	Easy
.doc	Document	Opens with Microsoft Word	Depends. The use of more text and images results in more storage needed	Quick	Easy
.gif	Graphic file	Opens in a web browser or graphics program	Depends on the size and resolution of the graphic	Quick	Easy
.jpg	Graphic file	Known as JPEG a format (Joint Photographic Experts Group). Opens in web browsers or an image editing program	Depends on the size and resolution of the graphic	Quick	Easy
.mov	Video file	Can open using	Depends on the	Depends	Intermediate

		Netscape, media-player or Internet Explorer	resolution of the video and its length. Can be 1MB or 20MB (or larger)	on size	- depending on size
.mp3	Audio file	Cd quality sound - usually compressed	Usually not very large, ~1 to 8 MB	Quick	easy
.mpg	Movie file	Known as MPEG (Motion Picture Experts Group)	Depends on the resolution of the video and its length. Can be anywhere from 3MB to 1GB	Depends on size	Intermediate - depending on size
.pdf	Application	Portable Document Format which opens with Adobe Acrobat Reader	Depends on the number of pages - usually not very large	Quick - program may take time to open though	Easy
.png	Image file	Portable Network Graphics	Depends on the size and resolution of the graphic	Quick	Easy
.tif	Image file	Stands for Tagged Image File	Depends on the size and resolution of the graphic	Quick	Easy
.wav	Audio file	Can open with Windows Media Player	A larger amount	Longer	Difficult - as they are large files
.zip	Application	A compressed file which needs to be opened by WinZip or PKzip	Small	Depends on the size	Usually easy

SOUND

How to capture and edit sound?



To be able to capture sound, we need appropriate hardware and software. In this case we are talking about a microphone, sound card with a software (also known as driver), which enables the user to set up the voice he/she wants and speakers, which will reproduce the captured sound. The user can use it to adjust the treble, bass, volume, using the soundcard software for individual purposes.

A couple of years ago sound editor was needed for sound editing. The sound editor was a creative professional responsible for selecting and assembling sound recordings in preparation for the final sound mixing or mastering of a television program or motion picture. Of course nowadays, the technology allows anyone to edit his/her own sound using appropriate software since the music and sound is stored in a digital format. Digital audio uses digital signals for sound reproduction. This includes analog-to-digital conversion and digital-to-analog conversion.

The sound we hear is stored in the computer in a special language known as the binary code (one's and zero's) so the computer can understand what each sound is and how to create it and reproduce it to the user through the speakers which are also connected to the soundcard.

The captured sound is usually an MP3 format, which is very easy to store and can be reproduced with the same quality every time. Here is an example of sound editing software which can also transfer the sound to different formats.

IMAGE

Important



The first thing you should know is how the process of **capturing** and later on **editing** the captured image works and what do we need for being able to do so.

Capturing images

To capture an image you need a camera. In this case I am talking about a digital camera, because the image captured with it can be transferred into a computer and then be modified and then be saved with the changes or modifications the user did on the picture. Not every digital camera is the same. Their functions differ in many ways, but the most important specification is the resolution(pixels). I won't talk about cameras. If you are interested in knowing more about them, check out the digital camera link.

Editing images

To edit an image, you need a special software. You will probably know the Adobe Photoshop, which is the most commonly used editing software in the world. Couple of years ago, it was very difficult to edit images, since the software was very difficult to work with but nowadays, pretty much anyone can edit his/her photograph image.

Storage

Almost all new digital cameras have their own memory, which is usually very low, so we need another device to be able to take and store more pictures on it. These devices are called flash memory cards and the most commonly used sizes are 254MB, 512MB, 1024MB, etc... The most commonly used types of memory cards are:

- Secure Digital (SD)
- CompactFlash (CF)
- Memory Stick (MS)

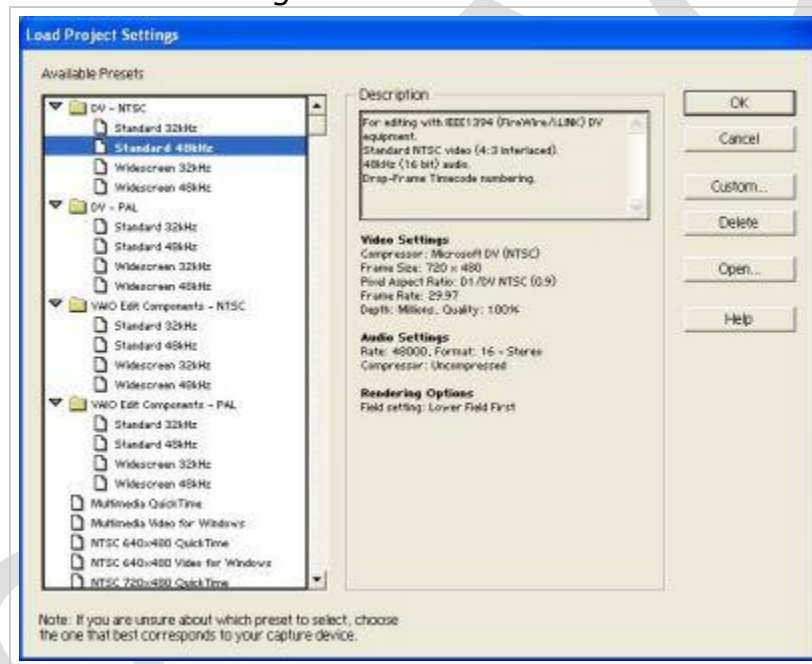
- MultiMediaCard (MMC)
- xD-Picture Card (xD)
- SmartMedia (SM)

The type of memory card you use is dictated by which digital camera you buy. These cards are physically different and are **not** interchangeable.

VIDEO CAPTURE AND EDITING

Ok, so how this thing works? Pretty much, during this developing age , you can **create and edit your own videos with just a use of a computer , a video camera and editing software**. Video editing simply enables you to create your own work and edit it to suit your own needs. Sounds cool , but in reality it is much more complicated than you think.

Many times, when you start the software such as Adobe Premiere you are introduced to the first screen that looks something like this:



It looks really confusing, doesn't it? So how we can make this whole video editing work?

Well, at first you need a standard PC ,ok... it can be standard as long as it has:

- Enough processing (CPU) power to manage the flow of data from the camera to the computer and also the whole process of editing.
- Enough hard disk space because during the process you move tons of data from and onto the hard drive.
- The bus of the memory to be high enough (in order for the application to work fast and reliable)

An important thing is that the PC has to be fast in order to keep up with the camera. The data or the finished movie has to be rendered and if you want to put it back onto a camera the computer has to be processing the data fast enough to match the transfer speed (For example the USB? Or FireWire? interface).

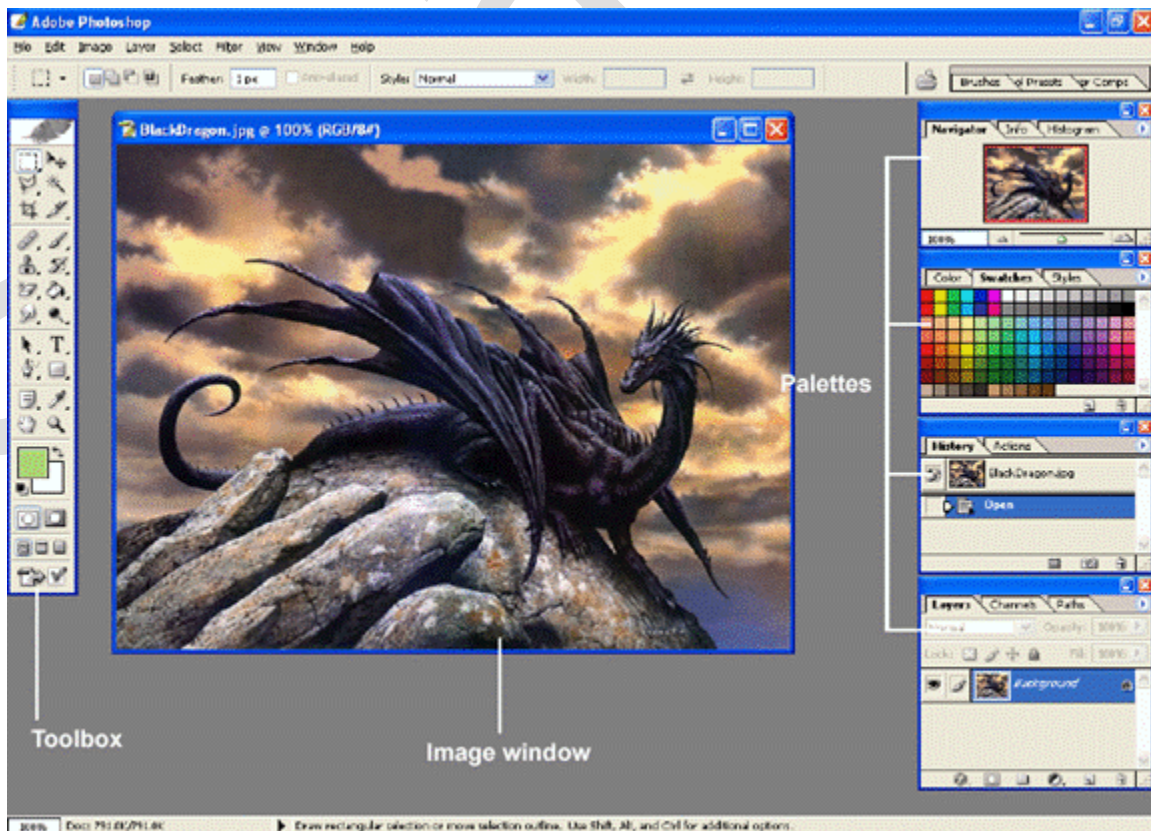
So once we have the computer and all the hardware hooked up , we obviously need the software. Windows comes in , equipped with a video-editing software embedded into the shell. Machines from Apple and Sony come with the editing software too.

Before we start editing, we need to capture the video. A capture is **moving the content out of the camera to the PC through the USB or FireWire cable**. There are 3 ways to capture a video:

- Capture the footage in a single file on your hard drive. The process is really space consuming and takes longer time to process.
- Take the video into smaller pieces (like 10 or so) and split the size. The data becomes more manageable.
- Software brings the footage shot by shot

After this the capture process will create AVI (on the PC) or MOV (on the Mac) files on your hard disk. Then you choose the shots you want to edit and put it onto the timeline to match the time.

UPDATING AND COMBINING



Updating and combining sounds and images at a later time to create new art work can be resourceful for many applications. Two good uses for this application is the combinations of existing images and layering and editing them to create a new, original artistic image. A second use is combining different sounds and audio files of different formats and combining them in an application such as Garage Band or Audacity to create a new song.

For the combination and processing of images, one of the most widely and commonly used programs to do this is Adobe Photoshop. Using this, you can import images from any location on the computer, and any format. Additionally, you can change the format of the image if desired. If you have a photograph stored on an external location such as an external hard drive or digital camera, all that is needed is to connect the device to the computer and upload the files onto the computer's hard drive, and then they can be imported into Photoshop. Once all the images that are needed are gathered, they are each a separate layer in the file, and can be processed individually. Once all the desired effects are added, you can "flatten" the image so you can have one, complete, new artistic image.

Similarly, audio files and different sounds can be imported, processed, and combined to make a song. Audio files of different formats can be imported, converted, and applied in many different programs such as Audacity and Garage Band. They can have additional sounds added to them, or can have effects, such as warping, reversing, and increasing or decreasing the speed, among many others. As these sound and modified, layered, and combined, a new song can be created.

SIM

MODELLING AND SIMULATIONS

Knowledge of Technology



Our Trip to the airport

Key terms

1. model, simulation, feedback loop
2. Faulty or hidden assumptions
3. Extent and effect of the simplification of reality
4. Extent to which the phenomenon being modeled is understood
5. Processing power needed to create complex models
6. Visualization of information
7. Correspondence of the model with reality". (IBO 2006)

Model:

- "to simulate (a process, concept, or the operation of a system), commonly with the aid of a computer"

- "a simplified representation of a system or phenomenon, as in the sciences or economics, with any hypotheses required to describe the system or explain the phenomenon, often mathematically" (Dictionary.com 2006)

Feedback Loop:

- "The section of a control system that allows for feedback and self-correction and that adjusts its operation according to differences between the actual output and the desired output." (American Heritage Dictionary 2006)



Simulation:

- "Simulation is the process of designing a model of a real or imagined system and conducting experiments with that model." (Smith 2000)
- "Simulation allows the analysis of a system's capabilities, capacities, and behaviors without requiring the construction of or experimentation with the real system. Since it is extremely expensive to experiment with an entire factory to determine its best configuration, a simulation of the factory can be extremely valuable. There are also systems, like nuclear reactions and warfare, which are too dangerous to carry out for the sake of analysis, but which can be usefully analyzed through simulation." (Smith 2000)

Advantages

- Able to test or experiment without harming the person or environment.
- Economic savings from the use of models to design and test new products before prototypes or the final product is made.

Disadvantages

- The mathematical (computational) calculations to simulate 'real life' situations or activities are very complex, maybe too complex to give a 'real' picture or outcomes. Therefore simulations really identify possible trends.
- Faulty or hidden assumptions
- Extent and effect of the simplification of reality
- Processing power needed to create complex models
- Can be costly to purchase the processing power and labor

Overviews and examples from external links

Before the widespread use of ICT in education simulation activities was more imitation or role-playing based activities. Now computer simulation allows the student to still role play but gives them a more 'realistic' or 'virtual' feel about it.

Simulations range from the edutainment games like SimCity, SimLife or The Sims, to the technical like, mathematical, medical or flying.

Weather/Global Warming Modelling: The read the following articles.

- An overview of [Weather Modelling](#)
- [IBM Research Weather Modelling Group](#)
- [Physorg weather modelling article](#)
- [Climate Models: How Reliable are Their Predictions?](#)

Educational/Edutainment Modelling

- An overview of [simulations](#) as well as examples.
- [Wikipedia](#) reference.
- [K-12 examples](#)
- [Real Lives](#) simulation of life in a global society.
- [NASA](#) Sim Labs

Military Simulations

Digital Experimentation

Digital Experimentation is the act of conducting experiments on a computer without ever physically touching the test subject. For example, engineers can digitally crash-test a car to observe how the crash-test dummies would react to the impact. Another way to digitally experiment is by using image-enhancing programs like Photoshop. Let's say you're wondering what you would look like with purple hair but you don't actually want to dye it: by using certain tools and techniques on Photoshop, you can!

Demographic and Environmental Simulation



Environmental -

An environmental simulator is a tool used by engineers and environmental-activists to study and research the environment. By using models and simulations of a certain area(s), professionals are able to observe the area's present state and draw conclusions as to what will happen to it in the future. These professionals are also able to study the effects of natural and human influences on the area and determine what actions are to be taken to preserve it.

An Urban Simulator is a tool used by architectures and engineers to plan and design a city. By using information technology and decision support systems they are able to design and develop buildings, houses, or large communities. These are created in 'real time' and therefore designers can fast-forward time to observe what the community may look like in a certain number of years. Clients of these companies are usually governments, institutions, developers, private investors, and community organizations.



Urban and Environmental simulators are used side by side to research the impact of building a city in a certain area or to study the impact of natural disasters on a future urban community.

SimCity, a popular computer game, makes use of both urban and environmental simulators.

Demographic -

Demographics refers to certain population characteristics such as race, age, gender, income, disabilities, literacy rate, home ownership, employment status, and location. It is useful for the government of a country, coming up with marketing strategies, and for economic research.

"Demographic trends however describe the changes in demographics in a population over a certain period of time. For example, the average age of a population may increase in a certain number of years."

Resource: "Demographics". Wikipedia. Sept 14, 07 <<http://en.wikipedia.org/wiki/Demographics> >.

Ethical and Social Issues

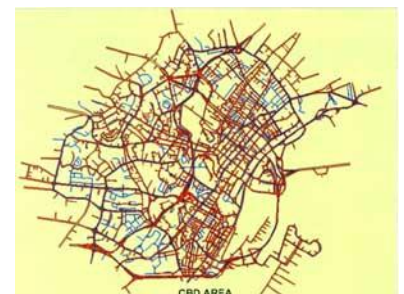
- "Reliability:
 - of predictions based on computer models, for example, weather, global warming
 - responsibility of the designer for accuracy of assumptions underlying the model
- Security:
 - issues involved in military simulations
- People and Machines:
 - ethical considerations involved in deciding when to use models or simulations to ensure human safety
 - economic effects of the use of models to design and test new products
 - social impact of reliance on simulations to examine issues of public policy" (IBO 2006)

Exercise - Military Simulations

Traffic Simulations

What are Traffic Simulations?

Network traffic simulation is a process used in telecommunications engineering to measure the efficiency of a communications network. Telecommunications systems are complex real-world systems, containing many different components which interact, in complex interrelationships. The analysis of such a system can become extremely difficult: modeling techniques tend to analyze each component rather than the relationships between components. Simulation is an approach which can be used to model large, complex stochastic systems for forecasting or performance measurement purposes. It is the most common quantitative modeling technique used. Simulation model can be defined as "a computer program that uses mathematical models to conduct experiments with traffic events on a transportation facility or system over extended periods of time". Some discussions refer to macro-simulation (travel forecasting models) versus micro-simulation (traffic operations models).



Some reasons for developing traffic models are:

To simulate the effect of control measures like:

- Speed limits
- Overtaking bans for trucks, especially at uphill or downhill sections
- Restrictions for lane changing, especially before or at merging regions
- Traffic flow control at on ramps
- To simulate the effect of new infrastructure before it has been build.
- To simulate the influence of vehicles with adaptive cruise-control systems. If an increasing percentage of vehicles has such systems, does traffic become more stable? Can the traffic flow per lane be increased?
- Finally one can even simulate different or new traffic rules. For example, allowing overtaking on freeways at either side combined with a speed limit.

For those of you who like to play games, here is a one related to simulations: <http://www.phy.ntnu.edu.tw/java/trafficControl/trafficControl.html>

Advantages of simulations:

- It is possible to easily compare alternative designs so as to select the optimal system
- The actual process of developing the simulation can itself provide valuable insights into the inner workings of the network which can in turn be used at a later stage
- Time and money saving
- Possible to test new traffic rules without putting humans into dangerous situations and comparing the results of different types of traffic rules

Disadvantages of simulations:

- Data can be incorrectly input
- Accurate simulation model development requires extensive resources
- The simulation results are only as good as the model and as such are still only estimates
- It is very costly to develop a good, reliable and realistic simulation



Social and Ethical Issues:

Reliability: Data may be unreliable if it is entered incorrectly or if it becomes outdated. The machines may break down or a hacker may violate the whole design by changing the data needed for the simulation.

Integrity: Again, a hacker may break into the system and change the data or the data could be accidentally changed.

Security: To make the simulation secure, it should be protected with a special password or a firewall if it is published at the internet, so only the right people access the core of the simulation, where they input or change the data.

Authenticity: Only people with a password will be able to input the data. Normal people are able to access the simulation most of the times from the internet to see how it looks like, without changing anything.

Equality of Access: People with an internet connection will be able to access the simulation; therefore they have to own a computer that has an internet connection.

Control: The control of simulations is very easy for the administrator of the simulation. If he or she enters the password needed to change some information, it is very easy to make changes, therefore control the design.

Policies and Standards: In this case, technology is used appropriately. It saves time, money and is nature friendly.

People and Machines: This design is very safe and effective if the data are correctly input. Technology makes work much easier, cheaper and faster.

Resources: www.wikipedia.com www.howstuffworks.com

External Links

Social Modelling and Public Policy: Application of Microsimulation Modelling in Australia

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